Memo

To: Aaron Yeow, USEPA/OSRTI

From: Mark Follansbee and Gary Diamond

Date: July 19, 2006

Re: Herculaneum rebuttal: definition of surface soil in TRW guidance and other precedence

---

At your direction, we have developed a rebuttal to the points made in the June 16 presentation by King and Spaulding (K&S), to Betsy. As requested, bullets have been prepared. Let me know if additional detail or information is needed (I have arranged these bullets sequentially for the presentation, combining where noted).

- As noted in the presentation, inputs to the IEUBK for soil lead concentration term should be collected from any portion of the upper 1 inch horizon that are representative of the exposure scenario and can be practically obtained.
- This is consistent with LSW Handbook (2003), Soil Screening Guidance (1996), TRW Shooting Range Guidance (2003), RAGS Part A (1989):
  - LSW Handbook (Page 26): "*In addition to the composite samples collected to define the vertical extent of contamination, fivepoint composite surface soil samples should be collected from 0 to 1 inch for human health risk assessment purposes (EPA, 1989, 1996c). The samples should be collected using the procedure described in Section 4.3.1. These surface soil samples should be collected from every property within the identified zone of contamination; however, after collecting a statistically valid number of both 0–1" and 1–6" samples, the project manager may want to compare both sample horizons (e.g., paired sample t-test; Wilcoxon Rank Sum test) (Gilbert, 1987; Snedecor and Cochran, 1989) to determine if the 0–1" depth can be eliminated (i.e., sample from 0–6"), to further decrease sampling costs. This may be particularly useful at mine waste sites where contamination often extends to depth or at sites where leadcontaminated soil has been used as fill material; in such cases, the lead concentration may increase with depth. Conversely, the 0–1" horizon may be far more contaminated than the 1–6" at smelter sites, making individual horizon sampling crucial to remedial decision-making.*" Material on slide 7 is missing this introductory text.
  - Soil Screening Guidance (pages 27 & 35) "*For purposes of soil screening analyses, EPA distinguishes between surface and subsurface soils as follows: surface soils are located within two centimeters of the ground surface, and subsurface soils are located more than two centimeters below the surface.*"

Defined directly in the SSG; I cannot find the language they cite on slides 8 & 9 in the online version (http://www.epa.gov/superfund/resources/soil/ssg_main.pdf).

- ☐ TRW Shooting Range Guidance is as shown on Slide 10 "*Sampling should be appropriate for the exposure scenario(s) that are to be considered in the risk assessment. Typically, this will dictate that samples be collected from the surficial soils (i.e., 0-1" depth interval) to assess current exposure scenarios.*" Key point is that the depth should be appropriate to the exposure scenario.
- ☐ RAGS Part A (4-12) "***Depth of samples.*** *Sample depth should be applicable for the exposure pathways and contaminant transport routes of concern and should be chosen purposively within that depth interval. If a depth interval is chosen purposively, a random procedure to select a sampling point may be established. Assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained, rather than, for example, zero to two feet. Subsurface soil samples are important, however, if soil disturbance is likely or if leaching of chemicals to ground water is of concern, or if the site has current or potential agricultural uses.*" Key point is that the assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained.

- Definition of surficial soil as 0-1 inch means that it includes any portion of that horizon that is consistent with the exposure scenario and can be practically obtained. The information presented on Slide 12 of the K&S presentation suggests misunderstanding of the example in the guidance. Assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained, rather than, for example, zero to two feet (RAGS Part A page 4-12). Zero to two feet is given as an example of an inappropriate sampling depth for surficial soil—not as a definition of surficial soil.
- Concerning IEUBK Validation studies, it is important to note that the validation exercise was opportunistic, rather than designed. From Hogan et al. (1998, page 1566 column 3): "Appropriate statistical procedures will be more constructive when a study can be designed for the explicit purpose of evaluating a model, including a thorough exposure assessment." It is clear from this language that the authors considered the exposure assessment portion of the validation to be imperfect (as opposed to the material presented on slides 14-16 of the K&S presentation.
- IEUBK FAQ on sampling depth: "***At what depth should soil samples be collected from for risk assessment purposes?*** *It is recommended that sampling designs be developed to provide the necessary data for all phases of a clean-up project (e.g., human and ecological risk assessment and remedial design) within one sampling effort to minimize mobilizations whenever feasible. This frequent question response provides recommendations for sampling depth for risk assessment, where the primary objective of the sampling effort is to estimate an average soil lead concentration for use in the IEUBK model. The recommendations made in this FAQ response should be incorporated within the sampling design that is developed for the site. This frequent question response assumes that data on the extent (e.g. depth) of contamination are already available for*

the site (e.g. from the Site Assessment process) or will be provided pursuant to other objectives of the sampling design. The appropriate sampling depth depends upon the conceptual site model (CSM) and the exposure scenario for the site. There may be more than one exposure scenario for the site, and therefore more than one CSM. For example, one exposure scenario on a site may be children playing in a residential yard with exposure to contaminated surface soil; the same site might also include a plausible scenario that involves the exposure of residents or construction workers to subsurface contamination (e.g., septic system repair, gardening; see the Superfund Lead-Contaminated Residential Sites Handbook (2003) available from the Guidance page). The sampling depth should be appropriate for the exposure pathways and contaminant transport routes of concern, and should be chosen with these considerations in mind. Keeping in mind the broader considerations (above), to assess risk from current exposure to contaminated surface soils, EPA has recommended the collection of surface soil from the top two to three centimeters (zero to one inch) of the soil layer, below organic litter or sod (see the 1996 EPA Soil Screening Guidance on the EPA Superfund Soil Screening Guidance Web page). The TRW and LSW agree that this depth best represents the soil and dust exposure for predicting child blood lead level using the IEUBK model, as well as for estimating the IEUBK's mass fraction of soil to dust parameter (MSD) (e.g., see the Superfund Lead-Contaminated Residential Sites Handbook (2003) available from the Guidance page; also see the TRW Recommendations for Performing Human Health Risk Analysis on Small Arms Shooting Ranges (2003) available from the Guidance page). These guidance documents recommend sampling from the top two to three centimeters (or shallowest depth that can be reasonably obtained, see below) because children are typically exposed to surface soil. These recommendations were intended to avoid using data from samples collected at depth (e.g., 0- to 6-inch depth interval) that might dilute contamination that is concentrated in the surface soils, thereby underestimating the exposure (and therefore risk) to children. If the concentration of lead is relatively homogeneous across the vertical extent of contamination, the potential for dilution does not exist; therefore, it makes no difference what depth interval the samples are collected from, provided they are collected from within the zone of relatively homogeneous contamination. If contamination is found in subsurface soils (i.e., greater than zero to one inch below the ground surface), then the risk assessment for the current exposure scenario should consider the likelihood that children may be exposed to soils at that depth, and select the sampling depth accordingly. Samples collected at depths greater than one inch below the ground surface may also be appropriate for future use scenarios (e.g. gardening, construction activities, yard maintenance). To assess risks from exposure to contaminated subsurface soils, samples should be collected from the depth interval that is consistent with the applicable exposure scenario. Samples below 1 inch are also useful for determining where institutional controls may be needed; contamination at depth that is left in place as part of the remedial action warrants institutional controls (see the Superfund Lead-Contaminated Residential Sites Handbook (2003) available from the Guidance page). Sampling depth also varies depending upon site-specific conditions. The Risk Assessment Guidance for Superfund (RAGS) Part A (EPA, 1989) states that the assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained. At some sites, it

might be possible to collect a sufficient quantity of soil at depths less than two centimeters (e.g. 0- to 1-centimeter depth interval). At other sites it may be difficult to obtain the required amount of soil material from the top two centimeters (e.g. due to rocks or debris). In these instances, the required quantity of sampled material should be obtained by slightly increasing the area sampled, rather than increasing the depth of the sample, to avoid the potential for diluting surface soil contamination (see above)." This is the complete FAQ response. Note that slide 18 omits much of the FAQ response, including the important highlighted portion.

- As for the Urban Soil Lead Abatement Demonstration Project and other sites in Region 7 (slides 19-23), the exposure scenario of concern for those will determine, perhaps individually due to practical considerations, the depth interval that best represents surficial soil exposure.
- As for the *concerns* listed in Slide 24 of the K&S presentation, it is important to clarify 2 points:
  - EPA policy is not to sample 1" cores, rather it is to sample from the soil horizon that best represents surficial soil (typically 0-1") and can be practically obtained.
  - The data suitable for evaluating human health risks using the IEUBK model are defined by the exposure scenario of concern. If in the assessment, it is believed that the soil lead concentration in the top ¼" of soil is more representative of exposures at the site than the soil lead concentration in the top 1" of soil and that the top ¼" can be practically obtained, then the top ¼' should be used.